

WHAT IS CLAIMED IS:

1. A power converter comprising
a power module having
a power controlling semiconductor element disposed
5 on the conductive member with an insulation member
interposed and
a current detector for detecting current which is
inputted into said power controlling semiconductor
element or outputted from said power controlling
10 semiconductor element; and
a control unit for controlling operation of said power
controlling semiconductor element, wherein
said current detector has
a conductor which is electrically connected to
15 said power controlling semiconductor element, is
disposed on said conductive member with an insulation
member interposed, and has a portion relative distance
of which to said conductive member is larger than
relative distance between the laminated portion
20 laminated on said conductive member with said
insulation member interposed and the conductive
member; and
a magnetic detecting unit which is disposed in
said conductor portion or in the vicinity of said
25 conductor portion relative distance of which to said

conductive member is larger than relative distance
between said conductor portion laminated on the
conductive member with the insulation member
interposed and said conductive member, and has a
5 magnetic detecting semiconductor element which is
electrically connected to said control unit.

2. A power converter according to claim 1,
wherein

relative distance between said conductor portion
10 equipped with said magnetic detecting unit or disposed
in the vicinity of said magnetic detecting unit and
said conductive member is larger than relative
distance between said power controlling semiconductor
element and said conductive member.

15 3. A power converter according to claim 1,
wherein

said conductor portion relative distance of which
to said conductive member is larger than relative
distance between said conductor portion laminated on
20 said conductive member with the insulation member
interposed and said conductive member protrudes in the
direction further away from said conductive member
than said conductor portion laminated on said
conductive member with said insulation member
25 interposed.

4. A power converter according to claim 1,
wherein

a portion of said conductive member that
corresponds to said conductor portion relative
5 distance of which to said conductive member is larger
than relative distance between said conductor portion
laminated on the conductive member with the insulation
member interposed and said conductive member is
thinner than the other portion.

10 5. A power converter according to claim 1,
wherein

said magnetic detecting unit is disposed in said
conductor portion or in the vicinity of said conductor
portion relative distance of which to said conductive
15 member is larger than relative distance between said
conductor portion laminated on said conductive member
with the insulation member interposed and said
conductive member so that said magnetic detecting unit
detects magnetic flux having a component parallel to
20 said conductive member or to induction current flowing
through said conductive member among magnetic flux
generated by said conductor portion relative distance
of which to said conductive member is larger than
relative distance between said conductor portion
25 laminated on said conductive member with the

insulation member interposed and said conductive member.

6. A power converter according to claim 1, wherein

5 said magnetic detecting unit is disposed in said conductor portion or in the vicinity of said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said
10 conductive member so that said magnetic detecting unit detects magnetic flux having a component parallel to the perpendicular line which vertically intersects with said conductive member among magnetic flux
15 generated by said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive
20 member.

7. A power converter according to claim 1, wherein

 said conductor portion relative distance of which to said conductive member is larger than relative
25 distance between said conductor portion laminated on

said conductive member with the insulation member
interposed and said conductive member has a portion
which is vertical to said conductive member and
extends in the direction away from said conductive
5 member, and

said magnetic detecting unit is disposed in said
conductor portion which is vertical to said conductive
member and extends in the direction away from said
conductive member so that the surface of the magnetic
10 detection surface of the said magnetic detecting
semiconductor element is vertical to said conductive
member and said conductor portion which extends in the
direction away from said conductive member and
parallel to said conductor portion which extends in
15 the direction away from said conductive member.

8. A power converter according to claim 1,
wherein

said conductor portion relative distance of which
to said conductive member is larger than relative
20 distance between said conductor portion laminated on
said conductive member with the insulation member
interposed and said conductive member has a portion
which extends parallel to said conductive member, and

said magnetic detecting unit is disposed in said
25 conductor portion which extends parallel to said

conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical and parallel to said conductor portion which extends parallel to said conductive member.

5 9. A power converter comprising
 a power module having
 a power controlling semiconductor element electrically connected to a load or an electric power supply means via a conductor,

10 a control unit for controlling operation of said power controlling semiconductor element, and
 a current detector disposed in said conductor, wherein

15 said current detector has a magnetic detecting unit which is configured such that a magnetic detecting semiconductor element and a part of a connecting conductor which electrically connects said magnetic detecting semiconductor element with said control unit are encased in resin, and

20 at least a part of said magnetic detecting unit is contained in a depression created in said conductor.

 10. A power converter according to claim 9, wherein

25 said conductor is an out-going electrode of said

terminal block in which the wire electrically
connected to said load or said electric power supply
means electrically connects an electrode of a terminal
block which is electrically connected by tightening a
5 screw with said power module or said control unit, and
said depression is provided in said out-going
electrode.

11. A power converter comprising
a power module having
10 a power controlling semiconductor element, and
a current detector for detecting current which is
inputted into said power controlling semiconductor
element or outputted from said power controlling
semiconductor element;

15 a control unit for controlling operation of said
power controlling semiconductor element; and

a conductive member through which induction
current flows due to electromagnetic induction
generated by current flowing through said current
20 detector, wherein

said current detector has
a conductor electrically connected to said power
controlling semiconductor element, and

a magnetic detecting unit which is disposed in
25 said conductor or in the vicinity of said conductor

and has a magnetic detecting semiconductor element
which is electrically connected to said control unit;
and

among magnetic flux generated by said conductor,
5 said magnetic detecting unit detecting magnetic
flux having a component parallel to said conductive
member or to said induction current flowing through
said conductive member.

12. A power converter according to claim 11,
10 wherein

said conductor has a portion extends in the
direction away from said conductive member, and

among magnetic flux generated by said conductor
portion which extends in the direction away from said
15 conductive member,

said magnetic detecting unit detects magnetic flux
having a component parallel to said conductive member
or to said induction current flowing through said
conductive member.

20 13. A power converter according to claim 11,
wherein

said conductor has a portion which is vertical to
said conductive member and extends in the direction
away from said conductive member, and

25 said magnetic detecting unit is disposed in said

conductor portion which is vertical to said conductive member and extends in the direction away from said conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said conductive member and said conductor portion extends in the direction away from said conductive member and parallel to said conductor portion which extends in the direction away from said conductive member.

10 14. A power converter according to claim 11, wherein

 said conductor extends parallel to said conductive member and has at least first and second bend, and

 among magnetic flux generated said conductor
15 portion located between said first bend and said second bend,

 said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or to induction current flowing through said
20 conductive member.

 15. A power converter according to claim 11, wherein

 said conductor extends parallel to said conductive member and

25 has at least first and second bend; and

said magnetic detecting unit is disposed in said conductor portion located between said first bend and said second bend so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said conductor portion located between said first bend and said second bend and said conductive member and parallel to said conductor portion located between said first bend and said second bend.

16. A power converter comprising
a power module having
a power controlling semiconductor element and
a current detector for detecting current inputted into said power controlling semiconductor element or outputted from said power controlling semiconductor element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current detector, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element, extends

parallel to said conductive member, and has at least first and second bend; and

5 a magnetic detecting unit which is disposed in said conductor portion located between said first bend and said second bend or in the vicinity of said conductor portion and has a magnetic detecting semiconductor element which is electrically connected to said control unit; and among magnetic flux generated by said conductor portion located between
10 said first bend and said second bend, said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or to said induction current flowing through said conductive member.

15 17. A power converter according to claim 16, wherein

said conductor consists of a first conductor which is said conductor portion located between said first bend and said second bend, a second conductor which
20 extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

among magnetic flux generated by said first
25 conductor,

said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

5 18. A power converter according to claim 16, wherein

 said conductor consists of a first conductor which is said conductor portion located between said first bend and said second bend, a second conductor which
10 extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

 said magnetic detecting unit is disposed in said
15 first conductor so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said first conductor and said conductive member and parallel to said first conductor.

 19. A power converter comprising
20 a power module having
 a power controlling semiconductor element, and
 a current detector for detecting current inputted into said power controlling semiconductor element or
 outputted from said power controlling semiconductor
25 element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current
5 detector, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element and has
10 at least first and second bend, and

a magnetic detecting unit which is disposed in said conductor portion located between said first bend and said second bend or in the vicinity of said conductor portion and has a magnetic detecting
15 semiconductor element which is electrically connected to said control unit, and

among magnetic flux generated by said conductor portion located between said first bend and said second bend,

20 said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

20. A power converter according to claim 19,
25 wherein

said conductor is said conductor portion located between said first bend and said second bend and consists of a first conductor which extends vertical to said conductive member, a second conductor which
5 extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

among magnetic flux generated by said first
10 conductor,

said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

15 21. A power converter according to claim 20, wherein

said second conductor and said third conductor have a right angle to said first conductor and extend in different directions.

20 22. A power converter according to claim 21, wherein

said second conductor and said third conductor extend in the opposite directions.

25 23. A power converter according to claim 22,

wherein

said magnetic detecting unit is disposed on the plane such that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said second conductor and said third conductor using said first conductor's axis as an intersecting point so that among magnetic flux generated by said first conductor, said magnetic detecting semiconductor element detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

24. A power converter according to claim 21, wherein

said third conductor extends in the direction at an obtuse angle (i.e. θ is more than 90 degrees and less than 180 degrees) with said second conductor.

25. A power converter according to claim 24, wherein

said magnetic detecting unit is disposed in the space in which the magnetic detection surface of said magnetic detecting semiconductor element is segmented by the plane vertical to said second conductor using the first bend as an intersecting point and in the space which is located on said third conductor side including said first conductor so that said magnetic

detecting semiconductor element detects magnetic flux
having a component parallel to said conductive member
or said induction current flowing through said
conductive member among magnetic flux generated by
5 said first conductor.

26. A power converter according to claim 24,
wherein

said magnetic detecting unit is disposed in the
space in which the magnetic detection surface of said
10 magnetic detecting semiconductor element is segmented
by the plane vertical to said second conductor using
the first bend as an intersecting point, and in the
space which is located on said third conductor side
including said first conductor and is segmented by the
15 plane vertical to said third conductor using said
second bend as an intersecting point, and also in the
space which overlaps with the space located on said
second conductor side including said first conductor
so that said magnetic detecting semiconductor element
20 detects magnetic flux having a component parallel to
said conductive member or said induction current
flowing through said conductive member among magnetic
flux generated by said first conductor.

27. A power converter comprising
25 a power module having

a power controlling semiconductor element, and
a current detector for detecting current inputted
into said power controlling semiconductor element or
outputted from said power controlling semiconductor
5 element;

a control unit for controlling operation of said
power controlling semiconductor element; and

a conductive member through which induction
current flows due to electromagnetic induction
10 generated by current flowing through said current
detector, wherein

said current detector has

a conductor electrically connected to said power
controlling semiconductor element, and

15 a magnetic detecting unit which is disposed in
said conductor or in the vicinity of said conductor
and has a magnetic detecting semiconductor element
which is electrically connected to said control unit,
and

20 among magnetic flux generated by said conductor,
said magnetic detecting unit detecting magnetic
flux having a component parallel to the perpendicular
line which vertically intersects with said conductive
member.

25 28. A power converter according to claim 27,

wherein

said conductor has a portion which protrudes in the direction away from said conductive member, and among magnetic flux generated by said conductor
5 portion protruding in the direction away from said conductive member; and

said magnetic detecting unit detects magnetic flux having a component parallel to the perpendicular line which vertically intersects with said conductive
10 member.

29. A power converter according to claim 27,
wherein

said conductor has a portion which protrudes in
15 the direction away from said conductive member and is parallel to said conductive member; and

said magnetic detecting unit is disposed in said conductor portion which protrudes in the direction away from said conductive member and is parallel to
20 said conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is parallel to said conductive member and is vertical and parallel to said conductor portion which protrudes in the direction away from said conductive
25 member and is parallel to said conductive member.

30. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 1 is used as said power converter.

31. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 9 is used as said power converter.

32. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 11 is used as said power converter.

33. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 16 is used as said power converter.

34. An electric power system for converting

electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 19 is used as said power converter.

35. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 27 is used as said power converter.

36. A mobile body comprising:
a body;
a driven device provided in said body;
a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 1 is used as said power converter.

37. A mobile body comprising:
a body;
a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

5 a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 9 is used as said power converter.

38. A mobile body comprising:

10 a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said
15 driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 11 is used as said power converter.

20 39. A mobile body comprising:

a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal
25 power source mounted to said body thereby driving said

driven device; and

a power converter for controlling electric power
supplied from said power source to said motor, wherein
a power converter according to claim 16 is used as
5 said power converter.

40. A mobile body comprising :

a body;

a driven device provided in said body;

a motor for being driven by an external power
10 source or electric power supplied from an internal
power source mounted to said body thereby driving said
driven device; and

a power converter for controlling electric power
supplied from said power source to said motor, wherein
15 a power converter according to claim 19 is used as
said power converter.

41. A mobile body comprising:

a body;

a driven device provided in said body;

20 a motor for being driven by an external power
source or electric power supplied from an internal
power source mounted to said body thereby driving said
driven device; and

a power converter for controlling electric power
25 supplied from said power source to said motor, wherein

a power converter according to claim 27 is used as
said power converter.